ANGLER HARVEST SURVEY

FISH LAKE 2010

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Key Findings

- Anglers spent 2,376 hours of angling effort on Fish Lake in the summer of 2010. At 1.8 hours of angling per hectare, this angling effort is high for a Yukon lake.

- Angler success (measured by the number of lake trout caught per hour of angling) was similar to the average for other Yukon fisheries surveyed to date.

- Anglers kept 66% of the 276 lake trout caught and 43% of the 249 Arctic grayling.

- Including both harvest and incidental mortality (death) from catch and release, the total summer mortality of lake trout was 181 kg. This is more than the estimated Optimal Sustainable Yield of 135 kg.

- Recent fish population assessments have shown that the lake trout population in Fish Lake is healthy. These results lessen the concern about possible overharvest.

- Because of the high angler harvest on Fish Lake, we recommend another angler harvest survey in 5 years and regular monitoring of the fish population. It is also important to collect harvest numbers for both the ice fishery and the First Nations subsistence fishery.

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Introduction

We conduct angler harvest surveys, also called creel surveys, on a number of Yukon recreational fisheries each year. We use these surveys, together with other fish and fishery-related assessments, to find out if the harvest of fish from the lake is sustainable. Environment Yukon tries to conduct angler harvest surveys on key fisheries every 5 years or according to angler patterns and management concerns. The results of the surveys directly contribute to management decisions that make sure fisheries are sustainable over the long term.

Fish Lake (Lu Zil Man) is in the south central Yukon within the traditional territory of Kwanlin Dün First Nation. It is a medium-sized lake with an area of 1320 hectares (13.2 km^2) and a mean depth of 16.5 m. It is 20 minutes southwest of Whitehorse, making it a popular day-use destination for many anglers. The lake is reached by the Fish Lake Road, a gravel road that is maintained year round. There are a number of cabins, houses, and properties close to the lake.

Fish Lake lies within the Yukon River basin and supports populations of lake trout, Arctic grayling, and round whitefish. Lake trout and Arctic grayling are the two most targeted species as they are both accessible from the shore and from boats.

A rich First Nations history at Fish Lake dates back thousands of years. Traditionally, the Kwanlin Dün First Nation had camps along the northern shore at Fox Point and at the nearby Bonneville Lakes, which they used for fishing, hunting, and gathering. A variety of ancient tools, arrowheads, and other artifacts have been recovered through archeological digs in these areas (Gotthardt and Hare, 1994).

Today the area is a popular destination for many activities, including fishing, hiking, dog sledding, snowmobiling, skiing, and camping. Hiking trails allow visitors easy access to alpine environments. In the winter Fish Lake provides a popular snowmobile corridor to many remote lakes, cabins, and properties that could otherwise only be reached by float plane.

This is the first angler harvest survey carried out on Fish Lake. In 2010 Fish Lake was chosen for surveying because of its local importance and lack of harvest information.

The survey was done to:

- determine how much time anglers spent fishing (effort);
- understand the fishery's characteristics and patterns of use;
- measure the success rate of anglers;
- compare the level of harvest to the productive capacity of the lake;
- record biological information on harvested fish;
- provide anglers with information about regulations; and
- establish a fisheries management presence.

Harvest Regulations

Fish Lake has been managed under the same general catch and possession limits since 1991/1992 (see Appendix 1 for the regulation history). The catch limit for lake trout is 3 fish per day and the possession limit is 6 fish. Anglers may keep only one lake trout over 65 cm. The catch limit for Arctic grayling is 5 fish per day and the possession limit is 10 fish. Anglers may keep only one grayling over 40 cm. General catch and possession limits apply to all other species and are listed in the Yukon Fishing Regulations Summary.

Methods

Survey

In 1990 the Yukon Government adopted survey methodology developed by the Ontario Ministry of Natural Resources (Lester and Trippel 1985). A field worker conducts face-to-face interviews with anglers on selected sample days throughout the summer. The worker asks a standard set of questions about the social and biological aspects of the fishery. Data gathered include:

- How much time did anglers spend fishing?
- What fishing methods did anglers use?
- How did anglers fish (boat, shore, etc.)?
- Were anglers guided?
- Where were anglers from?
- What type of visitor were anglers (day users, campers, etc.)?
- What kinds of fish were anglers trying to catch?
- How many fish did anglers catch?
- How many fish did anglers release?

Any other information offered by anglers about their fishing experience is also recorded.

The field worker also collects biological data on the catch of cooperative anglers. Biological data gathered include: length (mm), mass (g), sex, maturity, scales or an otolith (a small bone from the fish's head) for aging, and stomachs for content analysis in the lab. Any other information about general health and condition of the fish is recorded by the field worker (e.g., abnormalities, disease, lesions).

The field worker subjectively assesses the weather's effect on fishing over the entire sample day (no possible adverse effect, possible adverse effect, definite adverse effect).

The timing of the survey depends on management objectives, key species, and the nature of the fishery. It typically runs from ice out in the spring until either just after Labour Day or the end of September. The goal is to do sampling on at least 20% of the total survey days. The survey is subdivided into several seasonal periods (usually 3 or 4), which are further divided into weekends and weekdays. Each period has a minimum number of sample days, with a higher weighting and increased number of sample days for those periods with higher projected angler use.

Sample days are 14 hours long, 8:00AM to 10:00PM. On sample days, the field worker interviews all willing anglers. The field worker also records anglers who are observed but not interviewed.

Analysis

When the survey is finished, we enter the data into an Access database and analyze it using standard statistical methods. We determine the age of sampled fish by counting growth rings on the otolith. Diet is determined by examining the stomach contents.

Lake Productivity

The productivity of a lake determines the amount of fish produced annually and can guide how much harvest can be sustained. Estimates of lake productivity are calculated using average lake depth, the concentration of total dissolved solids, and the average annual air temperature at the lake. Ryder's morphoedaphic index (1974) is used and incorporated into Schlesinger and Regier's equation (1982) for calculation of maximum sustained yield (MSY) for all species. Calculation of MSY for lake trout assumes a biomass of 30% lake trout; where appropriate this may be replaced by the most recent survey data. Following O'Connor (1982) and others, 15% of MSY provides an "optimum" sustained yield (OSY), which maintains high quality fisheries on light to moderately fished lakes.

2010 Fish Lake Survey

The survey began on May 27 and ended on September 8, 2010.

We used an access survey method. The field worker was stationed at the boat launch at the northern tip of the lake (Figure 1) for the entire sample day. The worker interviewed angling parties at the end of their fishing trips. Because of the area's geography, this location is the only way for boaters to reach the lake.

Figure 1. Fish Lake, location of 2010 angler harvest survey (*).

The survey period was divided into 6 time periods: weekends and weekdays in June, July, and August/September. During the 106-day survey period, the field worker sampled on 37 days, giving a sampling effort of 35%.

We divided data analysis into two parts. In the first part, we combined data across all 6 time periods. In the second part, we compared results between time periods. All data were analyzed at both the angler party level and the individual angler level as appropriate.

Results of the 2010 Survey

Effort

We estimate that 2,376 hours of angler effort (fishing time) were spent on Fish Lake over the 2010 survey period. This is 1.8 hours of angling effort per hectare, a high value for Yukon lakes. Altogether, 907 anglers fished on Fish Lake for an average of 2.6 hours per angler. Fishing occurred for an average of 22.4 hours each day.

Fishing Methods

Trolling was the most popular method of fishing, followed by spin casting (Table 1). Fly casting, still fishing, and jigging were all observed in small numbers.

Table 1. Fishing methods, Fish Lake 2010.

Method of Fishing	Percent of Anglers
Still	7%
Jig	2%
Drift	
Troll	60%
Spin Cast	28%
Fly Cast	4%
Other or Combination	

Methods of Access

The majority of anglers used motorboats, with a strong showing by shore anglers (Table 2). A few anglers used canoes and kayaks.

Table 2. Angler access methods, Fish Lake 2010.

Access Method	Percent of Angler Parties
Canoe	5%
Rowboat	
Motorboat	56%
Shore	38%
Other	1%

Guided Anglers

No guided anglers were observed.

Angler Origin

Most anglers were from Whitehorse (Table 3). A few were local (Fish Lake area) and the remainder were from elsewhere.

Table 3. Angler origin, Fish Lake 2010.

Origin	Percent of Anglers
Local	8%
Whitehorse	84%
Yukon	1%
Canada	4%
U.S.	1%
Other	3%

Visitor Type

The majority of anglers were day users (Table 4). Very few groups camped on nearby Crown land.

Table 4. Angler visitor type, Fish Lake 2010.

User Type	Percent of Anglers
Day users	97%
Camper – Territorial campground	
Camper – Crown land	3%
Camper – Private campground	

Weather

Weather had a definite or possible adverse effect on 55% of the fishing days in 2010 (Table 5). Fish Lake can get very windy and rapidly becomes too wavy and dangerous for most small boats using the lake.

Table 5. Sample day weather, Fish Lake 2010.

Did Weather Affect Angling?	Percent of Angler Parties
No possible adverse effect	45%
Possible adverse effect	40%
Definite adverse effect	15%

Catch and Harvest

Lake trout were the most heavily caught and harvested species (Table 6). Arctic grayling, the only other species recorded, were caught in comparable numbers but weren't kept as frequently as lake trout.

Table 6. Angler catch and harvest, Fish Lake 2010.

Species	# Caught	# Kept	Retention Rate
Lake trout	276	183	66%
Arctic grayling	249	106	43%

Estimated angler catch per unit effort (CPUE, the number of fish per angler hour) over the entire survey can reflect changes in the fishery because it incorporates effort and catch. Dramatic decreases in CPUE for a particular species could indicate problems of health or status. However, relying on CPUE of anglers alone is not recommended (see the section entitled "Invisible Collapse" in *Status of Yukon Fisheries 2010* [Environment Yukon, 2010]). Anglers are very good at finding fish even when the population is in decline.

In Fish Lake, lake trout CPUE was near the Yukon average for lakes surveyed to date (Table 7; Yukon average is 0.13 for the most recent survey on each lake).

Table 7. Estimated catch per unit of effort (fish/hour), Fish Lake 2010.

Species	CPUE
Lake trout	0.12
Arctic grayling	0.10

Targeted Species

Anglers targeting a particular species were more successful than those who did not (Table 8). Seventy-six percent of anglers targeted lake trout and they were responsible for all of the lake trout catch and harvest. No lake trout were incidentally caught by anglers targeting other species. Twenty-one percent of anglers specifically targeted Arctic grayling, and those anglers were responsible for 56% of the Arctic grayling catch and 60% of the Arctic grayling harvest. The rest of the Arctic grayling catch was taken by anglers targeting lake trout.

Table 8. Catch and harvest by anglers targeting specific species, Fish Lake 2010.

Species	Percent of Angler Parties	Percent of Total Catch	Percent of Total Harvest
Lake trout	76%	100%	100%
Arctic grayling	21%	56%	60%

Biological Data

We sampled 33 lake trout for biological data. Mean fork length was 433 mm, mean weight was 919 g, and mean condition factor was 1.13. This condition factor (relationship between length and weight) is good for lake trout in Yukon and indicates "fat" fish. The sex ratio was 2.3 females per male. Anglers harvested similar numbers of lake trout across a small range of sizes from 362 to 482 mm (Figure 2). Fish ages are not presented but are available from Environment Yukon.

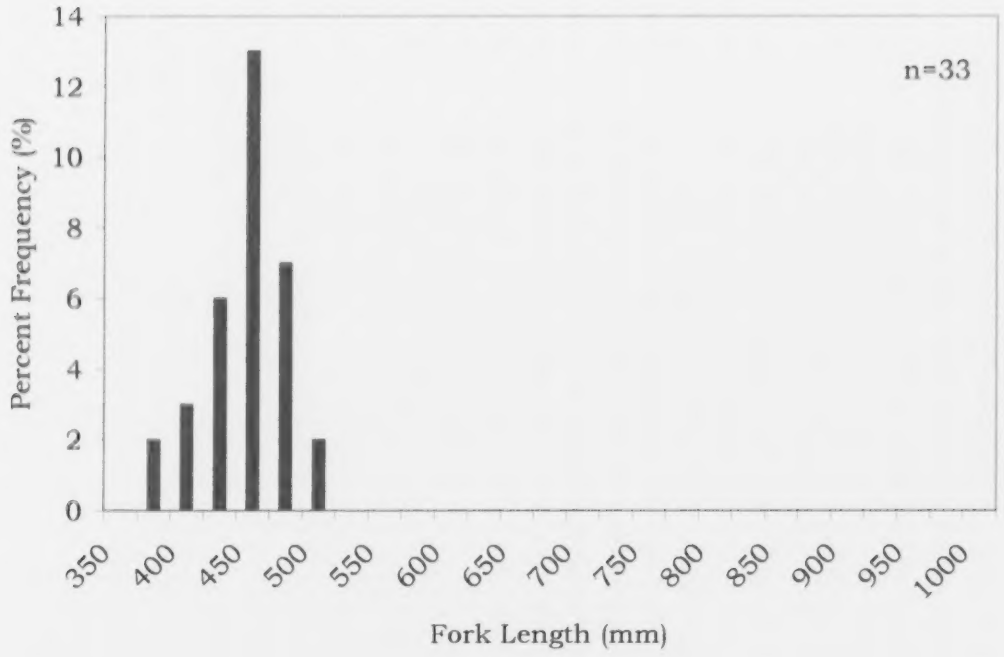

Figure 2. Lengths of lake trout caught by anglers, Fish Lake 2010.

We analyzed the stomach contents of 33 lake trout. Of these, one was empty and the remaining 32 averaged 60% full. Caddisflies were the most common diet item. Fish was a very small part of the diet (Table 9).

Table 9. Sampled lake trout stomach contents, Fish Lake 2010.

Stomach Content	Percent Volume
Caddisflies	60%
Scuds, side swimmers	15%
Orb snails	12%
Non-biting midges	8%
Unidentified invertebrates	2%
Clams, mussels	2%
Unidentified fish	1%
Pond snails	<1%
Unknown	<1%
Unidentified vegetation	<1%
Water mites	<1%
Water fleas	Traces
Snails	Traces

We analyzed the stomach contents of 9 Arctic grayling, which averaged 98.1% full. Unidentified invertebrates comprised the majority of grayling stomach contents (Table 10).

Table 10. Sampled arctic grayling stomach contents, Fish Lake 2010.

Stomach Content	Percent Volume
Unidentified invertebrates	92%
Caddisflies	2%
Unidentified mammal	2%
Unidentified vegetation	1%
Non-biting midges	1%
Predacious diving beetles	1%
Waterboatmen	<1%
Beetles	<1%
Pond snails	<1%
Water mites	Traces
Water fleas	Traces
Clams, mussels	Traces

Fishery Sustainability

Based on the estimated productivity of the system, we estimate that Fish Lake could sustain a total annual lake trout harvest of about 135 kg and still maintain a high quality fishery (see Methods - *Lake Productivity*). Predictions of sustainable yield are imprecise, so we attempt to minimize risk and maintain fishery quality by using conservative estimates.

Anglers harvested 183 lake trout from Fish Lake over the summer (Table 11). Total fish mortality (death) includes the unintentional mortality of any released fish. Catch and release, when done properly, has a minimal impact. Lake trout survival rates range from 93% for lightly handled fish to 76% for deep-hooked fish (YFWMB 1998). We used an average of 85% survival. For the 93 lake trout released in 2009, this results in an additional mortality of 14 fish for a total of 197 fish. Based on the average size of harvested fish, the weight of total lake trout mortality in the recreational fishery was 181 kilograms. We consider this a minimum, because additional harvests from the open water fishery outside the survey period, the ice fishery, and the First Nations subsistence fishery are not included. No information is currently available on these fisheries.

The impact of the recreational fishery on lake trout in Fish Lake appears to be at a level of concern when compared to the estimates of productivity of the lake. However, other sources of information suggest that this concern may not be warranted. Recent fish population assessments on Fish Lake show that the lake has an abundant population of small-bodied lake trout (Jessup and Millar 2012). These conflicting results highlight some of the uncertainties in estimating sustainable yield from ecological factors in the absence of fish population data, especially for lakes with small-bodied lake trout.

Table 11. Minimum summer lake trout harvest by anglers, Fish Lake 2010.

Lake Trout Harvest	2010
Lake trout harvested	183
Lake trout released	93
Lake trout mortality from catch and release	14
Total lake trout mortality	197
Mean weight of lake trout	0.919 kg
Weight of total lake trout mortality	181 kg

Since the harvest may be high for this system, we recommend carrying out an angler harvest survey and a fish population assessment within 5 years. Information on ice fishing and the size of the First Nation subsistence fishery should also be collected. Finally, the estimated productivity of Fish Lake should be refined so that we are able to provide a more definitive assessment of the status of lake trout in this popular and accessible fishery.

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APPENDIX 1. Fish Lake angling regulation changes 1989 to 2010.

Year	Species	Catch limit	Possession limit	Size restrictions
1989/90*		General Regulations		
	Lake trout	3	6	Only one fish over 80 cm
	Arctic grayling	5	10	none
	Northern pike	5	10	none
	Whitefish	5	10	none
1991/92		General Regulations		
	Lake trout	3	6	Only one fish over 65 cm
	Arctic grayling	5	10	Only one fish over 40 cm
	Northern pike	5	10	Only one fish over 75 cm
	Whitefish	5	10	none

* Yukon Government obtained responsibility for freshwater fisheries management from the federal government in 1989.

APPENDIX 2. 2010 Results- Comparisons between Periods

Effort

Mean daily angler effort was high throughout May/June and July. Weekday effort, though generally lower than weekends, was higher than most fisheries in the Yukon. There was a slight drop in August/September from July (Figure 4).

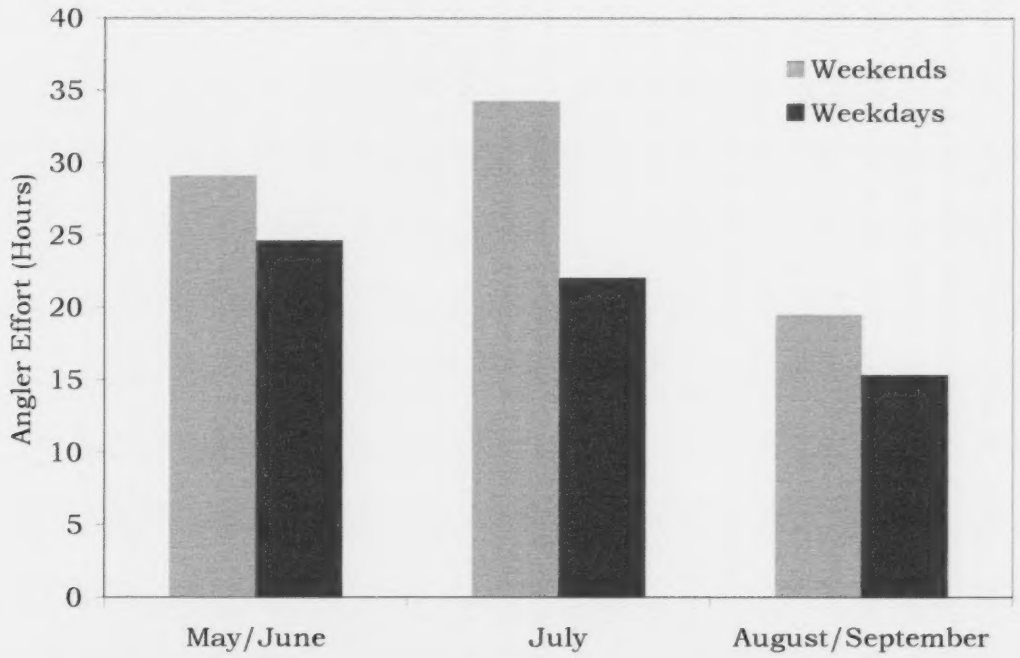

Figure 2.1. Estimated angler effort per day, Fish Lake 2010.

Visitor Type

Day users were almost consistently the only visitor type over the entire survey period.

Catch

Lake trout CPUE was highest on weekends in June and July. Lake trout CPUE was lowest on weekends in August/September and weekdays in July and August/September (Table 12). Arctic grayling CPUE was highest on weekends in July and August/September.

Catch per unit effort patterns for lake trout in Fish Lake are consistent with typical Yukon summer patterns. Success is high in the spring following ice out and then drops as water temperature warms. Fall increases are usually related to onset of spawning and cooling water temperatures.

Table 2.1. Estimated catch per unit of effort (fish/hour) by period, Fish Lake 2010.

Period	Lake Trout	Arctic Grayling
June weekends	0.22	0.12
June weekdays	0.14	0.12
July weekends	0.25	0.25
July weekdays	0.07	
August/September weekends	0.02	0.04
August/September weekdays	0.06	0.23